AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the subject application.

Claim 1. (Currently Amended) A robot for use with a human-controllable steerable catheter that includes a thumb control ~~adapted~~ configured to manually control a deflection of a distal tip of the catheter and a position sensor configured to generate a position signal indicative of six dimensions of location and orientation information, the position sensor fixed in a vicinity of the distal tip of the catheter, ~~and adapted to generate a position signal,~~ the robot comprising:

an end-effector~~, adapted to be~~ coupled to the thumb control; and

a controller~~, adapted~~ configured to ~~receive the position signal, the position signal being indicative of six dimensions of location and orientation information, the controller being adapted to~~ non-manually manipulate the thumb control in response to the position signal to drive the end-effector to position the distal tip of the catheter at a desired position based on the six dimensions of location and orientation information.

Claim 2. (Currently Amended) The robot according to claim 1, wherein the controller is ~~adapted~~ configured to drive the end-effector to deflect the distal tip by moving the thumb control longitudinally with respect to a longitudinal axis of the catheter.

Claim 3. (Currently Amended) The robot according to claim 1,

wherein the catheter includes a handle~~, adapted~~ configured to control a roll of the distal tip,

wherein the robot comprises a handle end-effector~~, adapted to be~~ coupled to the handle, and

wherein the controller ~~is adapted to manipulate~~manipulates the handle to drive the handle end-effector to roll the distal tip.

Claim 4. (Currently Amended) The robot according to claim 1,

wherein the catheter includes a handle~~, adapted~~ configured to advance and withdraw the catheter,

wherein the robot comprises a handle end-effector~~, adapted to be~~ coupled to the handle, and

wherein the controller ~~is adapted to drive~~drives the handle end-effector to perform, by manipulating the handle, at least one action selected from the list consisting of: advancing the catheter and withdrawing the catheter.

Claim 5. (Currently Amended) The robot according to claim 1, comprising a computer pointing device~~, adapted to receive~~ receiving an indication of a desired position of the distal tip of the catheter.

Claim 6. (Currently Amended) Apparatus comprising:

a human-controllable steerable catheter[[,]] comprising a thumb control~~, which is adapted~~ configured to manually control a deflection of a distal tip of the catheter and a position sensor configured to generate a position signal indicative of six dimensions of location and orientation

information, the position sensor being fixed in a vicinity of the distal tip of the catheter~~, and adapted to generate a position signal~~; and

a robot, comprising:

an end-effector~~, adapted to be~~ coupled to the thumb control; and

a controller~~, adapted~~ configured to ~~drive the end-effector to deflect the distal tip adapted to receive the position signal, wherein the position signal is indicative of six dimensions of location and orientation information, and, responsive thereto, to~~ non-manually manipulate the thumb control in response to the position signal to drive the end-effector to position the distal tip of the catheter at the desired position based on the six dimensions of location and orientation information.

Claim 7. (Currently Amended) A robot for use with a human-controllable steerable catheter that includes controls ~~adapted~~ configured to control a deflection of a distal tip of the catheter and a position sensor configured to generate a position signal indicative of six dimensions of location and orientation information, the position sensor being fixed in a vicinity of the distal tip of the catheter, ~~and adapted to generate a position signal, which~~ and the controls ~~are~~ being generally optimized for manipulation by a human hand, the robot[[,]] comprising:

at least one end-effector~~, adapted to be~~ coupled to at least a portion of the controls; and

a controller~~, adapted to receive the position signal, wherein the position signal is indicative of six dimensions of location and orientation information, and, responsive thereto, to drive the end-effector to position the distal tip of the catheter at the desired position based on the six dimensions of location and orientation information, said controller being adapted~~ configured

to drive the at least one end-effector to deflect the distal tip in response to the position signal by inducing motion of the portion of the controls that generally mimics motion of the portion of the controls induced when a human hand manipulates the controls.

Claim 8. (Currently Amended) The robot according to claim 7, wherein the controller is ~~adapted~~ configured to drive the end-effector to deflect the distal tip by moving the portion of the controls longitudinally with respect to a longitudinal axis of the catheter.

Claim 9. (Currently Amended) The robot according to claim 7,

wherein the controls are ~~adapted~~ configured to control a roll of the distal tip,

wherein the robot comprises a roll end-effector~~, adapted to be~~ coupled to the controls, and

wherein the controller is ~~adapted~~ configured to drive the roll end-effector to roll the distal tip by inducing motion of the controls that generally mimics motion of the controls induced when a human hand manipulates the controls.

Claim 10. (Currently Amended) The robot according to claim 7,

wherein the controls are ~~adapted~~ configured to advance and withdraw the catheter,

wherein the robot comprises a longitudinal motion end-effector~~, adapted to be~~ coupled to the controls, and

wherein the controller is ~~adapted~~ configured to drive the longitudinal motion end-effector to perform, by inducing motion of the controls that generally mimics motion of the controls induced when a human hand manipulates the controls, at least one action selected from the list consisting of: advancing the catheter and withdrawing the catheter.

Claim 11. (Currently Amended) The robot according to claim 7,

comprising a computer pointing device~~, adapted~~ configured to receive an indication of a desired position of the distal tip of the catheter.

Claim 12. (Currently Amended) Apparatus comprising:

a human-controllable steerable catheter[[,]] comprising controls ~~adapted~~ configured to manually control a deflection of a distal tip of the catheter and a position sensor configured to generate a position signal indicative of six dimensions of location and orientation information, the position sensor being fixed in a vicinity of the distal tip of the catheter, and ~~adapted to generate a position signal, which~~ and the controls ~~are~~ being generally optimized for manipulation by a human hand; and

a robot, comprising:

at least one end-effector~~, adapted to be~~ coupled to at least a portion of the controls; and

a controller~~, adapted to receive the position signal, wherein the position signal is indicative of six dimensions of location and orientation information, and, responsive thereto,~~ configured to drive the end-effector to position the distal tip of the catheter at the desired position based on the six dimensions of location and orientation information ~~adapted to drive the at least one end-effector to deflect the distal tip~~ by inducing motion of the portion of the controls that generally mimics motion of the portion of the controls induced when a human hand manipulates the controls.

Claim 13. (Currently Amended) Apparatus comprising:

a human-controllable steerable catheter, comprising:

a distal tip ~~adapted~~ configured to be controllably deflectable in no more than two directions for any given rotation of the distal tip, such that a set of all points to which the tip can be deflected at the given rotation forms a deflection curve for the given rotation; and

a position sensor~~, fixed in a vicinity of the distal tip, and adapted~~ configured to generate a position signal indicative of six dimensions of location and orientation information, the position sensor being fixed in a vicinity of the distal tip;

a robot~~, adapted~~ configured to manipulate a proximal end of the catheter; and

a control unit~~, adapted~~ configured to:

receive the position signal, and

position the distal tip of the catheter at a target by manipulating the robot in response to the position signal to:

position the distal tip of the catheter in a vicinity of the target, responsive to the position signal based on the six dimensions of location and orientation information,

rotate the proximal end of the catheter in order to cause the distal tip of the catheter to roll to a rotation the deflection curve of which includes the target, the rotation determined responsive to the position signal, and

deflect the distal tip of the catheter along the deflection curve to the target.

Claim 14. (Currently Amended) The apparatus according to claim 13, wherein the distal tip is ~~adapted~~ configured to be controllably deflected in no more than one direction for the given rotation of the distal tip.

Claim 15. (Currently Amended) The apparatus according to claim 13, wherein the control unit is ~~adapted~~ configured to position the distal tip in the vicinity of the target by positioning the distal tip so that the deflection curve of at least one rotation of the distal tip includes the target.

Claim 16. (Currently Amended) The apparatus according to claim 13, comprising a computer pointing device~~, adapted~~ configured to receive an indication of a position of the target, wherein the control unit is ~~adapted~~ configured to drive the robot to position the distal tip at the position of the target, responsive to the position signal.

Claim 17. (Cancelled)

Claim 18. (Currently Amended) Apparatus comprising:

a human-controllable steerable catheter having a distal tip, the catheter comprising a position sensor~~, fixed in a vicinity of the distal tip, and adapted~~ configured to generate a position signal indicative of six dimensions of location and orientation information, the position sensor being fixed in a vicinity of the distal tip;

a robot~~, adapted~~ configured to be coupled to a proximal end of the catheter; and

a control unit~~, adapted~~ configured to:

drive the robot to apply rotation to the proximal end of the catheter,

receive the position signal,

responsive to the six dimensions of location and orientation information of the position signal, determine a roll of the distal tip of the catheter, and

responsive to a determination that the roll lags the rotation, drive the robot to move a portion of the proximal end of the catheter.

Claim 19. (Currently Amended) The apparatus according to claim 18, wherein the control unit is ~~adapted~~ configured to drive the robot to move the portion of the proximal end of the catheter to perform at least one action selected from the list consisting of: straightening the distal tip and deflecting the distal tip.

Claim 20. (Currently Amended) The apparatus according to claim 18, wherein the control unit is ~~adapted~~ configured to drive the robot to move the portion of the proximal end of the catheter to effect translational back and forth motion of the distal tip.

Claim 21. (Currently Amended) The apparatus according to claim 18, wherein the control unit is ~~adapted~~ configured to drive the robot to move the portion of the proximal end of the catheter to perform at least one action selected from the list consisting of: advancing the distal tip and withdrawing the distal tip.

Claim 22. (Cancelled)

Claim 23. (Currently Amended) The apparatus according to claim 18, wherein the control unit is ~~adapted~~ configured to move the portion of the proximal end of the catheter to jiggle the distal tip.

Claim 24. (Currently Amended) The apparatus according to claim 23, wherein the control unit is ~~adapted~~ configured to jiggle the distal tip by rotating the proximal end of the catheter.

Claims 25-34. (Cancelled)

Claim 35. (Currently Amended) A method for use with a steerable catheter having a distal tip ~~adapted~~ configured to be controllably deflectable in no more than two directions for any given rotation of the distal tip, such that a set of all points to which the tip can be deflected at the given rotation forms a deflection curve for the given rotation, the method comprising:

receiving a position signal indicative of six dimensions of location and orientation information from a vicinity of the distal tip of the catheter; and

robotically positioning the distal tip of the catheter at a target by:

robotically positioning the distal tip of the catheter in a vicinity of the target, responsive to the six dimensions of location and orientation information of the position signal,

robotically rotating the proximal end of the catheter in order to cause the distal tip of the catheter to roll to a rotation the deflection curve of which includes the target, the rotation determined responsive to the six dimensions of location and orientation information of the position signal, and

robotically deflecting the distal tip of the catheter along the deflection curve to the target.

Claim 36. (Original) The method according to claim 35, wherein robotically positioning the distal tip in the vicinity of the target comprises robotically positioning the distal tip so that the deflection curve of at least one rotation of the distal tip includes the target.

Claim 37. (Original) The method according to claim 35, comprising receiving an indication of a position of the target, wherein robotically deflecting the distal tip comprises robotically deflecting the distal tip to the position of the target, responsive to the position signal.

Claim 38. (Cancelled)

Claim 39. (Currently Amended) A method for use with a human-controllable steerable catheter having a distal tip and a proximal end, the method comprising:

robotically rotating the proximal end of the catheter;

receiving a position signal indicative of six dimensions of location and orientation information from a vicinity of the distal tip of the catheter;

responsive to the position signal, determining a roll of the distal tip; and

responsive to a determination that the roll lags the rotation, robotically moving a portion of the proximal end of the catheter, wherein the steps of robotically rotating and robotically moving are performed non-manually.

Claim 40. (Original) The method according to claim 39, wherein robotically moving the portion of the proximal end of the catheter comprises robotically performing at least one action selected from the list consisting of: straightening the distal tip and deflecting the distal tip.

Claim 41. (Original) The method according to claim 39, wherein robotically moving the portion of the proximal end of the catheter comprises robotically translating the distal tip back and forth.

Claim 42. (Original) The method according to claim 39, wherein robotically moving the portion of the proximal end of the catheter comprises robotically performing at least one action selected from the list consisting of: advancing the distal tip and withdrawing the distal tip.

Claim 43. (Cancelled)

Claim 44. (Original) The method according to claim 39, wherein robotically moving the portion of the proximal end of the catheter comprises robotically jiggling the distal tip.

Claim 45. (Original) The method according to claim 44, wherein robotically jiggling the distal tip comprises robotically rotating the proximal end of the catheter.